In the Beginning Was the Rhyme?

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Phonological sensitivity at different grain sizes is a good predictor of reading acquisition in all languages. However, prior to any explicit tuition in alphabetic knowledge, phonological sensitivity develops at the larger grain sizes—syllables, onsets, and rimes—in all languages so far studied. There are also developmental differences in the grain size of lexical representations and reading strategies across orthographies. Phoneme-level skills develop fastest in children acquiring orthographically consistent languages with a simple syllabic (CV) structure, such as Finnish and Italian. For English, however, both “large” and “small” units are important for the successful acquisition of literacy.© 2002 Elsevier Science (USA)

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In the area of reading development, there has been considerable debate about the grain size of the orthography–phonology correspondences that are basic to the acquisition of reading. This “small versus large unit” debate is the focus of the paper by Hulme et al. (2002), who frame it in terms of “the relative importance of small versus large phonological units as predictors of individual differences in reading skills” (p. 3, my italics). Others have framed the debate in terms of whether small units or large units are used first in reading acquisition (e.g., Duncan, Seymour, & Hill, 1997). Both frames may set up a misleading dichotomy. Adoption of a developmental perspective suggests that whether children use small or large units in reading depends on the nature of the reading task, the type of words being read, the methods of reading tuition that they are experiencing, and the orthography under investigation (e.g., Brown & Deavers, 1999; Goswami & East, 2000; Goswami, Gombert, & De Barrera, 1998; Perry & Ziegler, 2000). Similarly, adoption of a developmental perspective suggests that whether small or large units are the best predictors of individual differences in reading may depend on the developmental level of the children being studied, the type of phonological awareness task being given to the child, whether extensive small unit teaching characterizes early reading tuition, and the orthography under investigation.

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The Learning Problem in Reading

Consider the learning problem facing a child encountering written English. The child needs to learn how letters represent sounds. It is well documented that an individual child’s phonological sensitivity will help to determine whether the child finds this learning task easy or difficult (e.g., Goswami & Bryant, 1990; Lonigan, Burgess, & Anthony, 2000; Stanovich, 1992). Individual differences in phonological sensitivity can be measured in a variety of ways in children who can already read. However, in prereaders individual differences in phonological sensitivity are only measurable in terms of large units—syllables, onsets, and rimes. The majority of prereaders do not develop phonemic awareness—at least, in terms of those skills measured by most phonemic awareness tasks—until they are being taught to read and spell. Once explicit tuition commences, the picture changes very quickly. “There is no doubt that for children of 5 and 6 years of age, the experience of being taught to read and spell is an extremely effective way to learn about phonemes. Moreover, the effects are rather rapid” (Goswami & Bryant, 1990, p. 148).

The most fine-grained level of segmental phonology usually available to the truly beginning reader is that of the onset and the rime. This level of phonological accessibility is not matched in the orthography. The most accessible unit in print is that of the single letter, and indeed most teaching begins from the letter. In England, all 5-year-olds are now taught letter–sound correspondences as part of the National Literacy Strategy (DfEE, 1998). They are also explicitly taught how to sound out and blend, so that phonological recoding at the small unit level can be directly applied to reading. The National Literacy Strategy does not recommend formally teaching children about larger spelling sequences such as those representing rimes until the second year of literacy instruction, when a small-unit foundation is already in place. Beginning readers in England (5-year-olds) are taught first about the sounds of letters in the initial position in CVC words, then about the sounds of letters in the final position, and then about the sounds of letters in the medial position. Small-unit (grapheme–phoneme) correspondences are initially easy to teach, because individual letters are explicitly represented in the written input.

At first sight it may seem peculiar that spelling correspondences for the large units (rimes) that are phonologically easier to process are taught later than spelling correspondences for the small units (phonemes) that are phonologically more difficult to process. However, the small units (phonemes) usually correspond to single letters, which are clearly separable in the orthography, and most words used in

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1 Whether these skills are truly phonemic is questionable, of course. Most phonemic awareness tasks are probably solved on the basis of orthography. Most children think that pitch has more phonemes than rich and that foot has more phonemes than put (e.g., Ehri & Wilce, 1980; Tunmer & Nesdale, 1985). Even most college students cannot make judgments about phonemes without the support of letters. Scholes (1998) reported that, whereas 86% of literate adults could delete the 4th sound from “stable” (to leave “stale”), only 6% of the same adults could delete the 4th sound from “faxed” (to leave “fact”). Only the former has a letter representing the phoneme to be deleted (the phonemes are /bl/ and /sl/ respectively).
the early reading curriculum have a 1:1 correspondence between letters and sounds. Furthermore, many children learn the alphabet before formal teaching in reading commences, and there is good evidence that this letter knowledge helps them once they begin learning to read (e.g., Treiman, Tincoff, Rodriguez, Mouzaki, & Francis, 1998). Hence pedagogically it may well be easier to begin teaching children about letters, which many of them will already know about, and then to proceed to instruction about larger units such as rimes (e.g., Allen, 1998; Johnston, 1999; Moustafa & Maldonado-Colon, 1998; Wagstaff, 1997).

At the same time, however, work with skilled adult readers of English has shown that these small units are highly inconsistent in pronunciation. English graphemes can be pronounced in multiple ways and their pronunciation can be spelled in multiple ways (e.g., Berndt, D’Autrechy, & Reggia, 1994). For English, it is the larger units, such as rimes, that have the advantage of being less inconsistent in spelling–sound correspondence (e.g., Treiman, Mullemnix, Bijeljac-Babic, & Richmond-Welty, 1995), and rime-level representations feature strongly in the adult visual word recognition system (e.g., Ziegler & Perry, 1998). This potential conflict between what is easy phonologically versus what is easy orthographically has led Brown and Ellis (1994) to argue that beginning readers are faced with the difficult task of establishing a mapping between incompatible levels of representation in the orthographic and phonological domains. The “easy” orthographic units are phonologically harder (and more inconsistent), while the phonologically easy units may be orthographically harder (although less inconsistent).

Children can certainly begin learning about large orthographic units from the beginning of reading acquisition (Moustafa, 1995; Walton and Walton, 2002; Walton, Bowden, Kurtz & Angus, 2001), and children who are explicitly taught about large units rather than small units appear to make broadly equivalent progress in reading to children taught about small units first (Walton, Walton, & Felton, 2001). However, early explicit teaching about large units is not the norm in English schools. The teaching of reading still begins with letters. Logically, therefore, it is not surprising that when Hulme et al. (2002) studied a cohort of English children who were already being taught to read by small unit methods, phonemic awareness was a very strong predictor of reading. Phonemic awareness depends on letters, and so does early reading tuition in England. If Hulme et al. (2002) had studied prereaders, they would not have been able to use their phonemic awareness tasks. Like Bryant et al. (1989), they would have had to give 3- and 4-year-olds phonological awareness tasks based on rhyme and alliteration. They would only have been able to introduce phonological awareness tasks based on phonemes at the age of around 5 years 6 months (as in Hulme et al., 2002, or 5 years 7 months, as in Bryant, Bradley, Maclean, & Crossland, 1989).

Why Rhyme?

If phonemic awareness is a product of reading, and is the best predictor of reading once children are being taught about letters, then we might ask why onset--
rime awareness should predict reading in English at all. As proposed a long time ago (Goswami & Bryant, 1990; Stanovich, 1992), the answer lies partly in the nature of phonological sensitivity in prereaders. Onset–rime awareness is a strong predictor of reading when measured prior to literacy (e.g., Bradley & Bryant, 1983; Bryant et al., 1989) and usually continues to be a longitudinal predictor of reading even in children who are readers (e.g., Hulme et al., 2002; see Goswami, 1999, for a full discussion). Onset–rime awareness also predicts reading in transparent languages such as Norwegian, Swedish, and German, even though its predictive power is usually weaker than that of phonemes (e.g., Hoien, Lundberg, Stanovich, & Bjaalid, 1995; Lundberg, Olofsson, & Wall, 1980; Wimmer, Landerl, & Schneider, 1994). Why might awareness of onset–rime predict reading even in transparent orthographies for which rimes are not useful orthographic units? One possibility lies in the origins of phonological awareness.

Metsala and Walley (1998) have proposed that one logical source of the development of phonological awareness skills in young children is vocabulary acquisition. Vocabulary grows at an exponential rate in early childhood and presumably requires increasing neural organization in terms of factors such as phonological similarity and semantic similarity. Thus phonological awareness may emerge as a result of lexical restructuring processes that are an intrinsic part of language acquisition (Metsala, 1999; Metsala & Walley, 1998; Walley, 1993). Metsala and Walley propose that, when vocabulary size is small, there is no need to represent words in a systematic or detailed manner, and so early word representations are holistic, representing fairly global phonological characteristics (e.g., Ferguson, 1986; Jusczyk, 1986, 1993; Walley & Flege, 1999). As vocabulary grows, these holistic representations are gradually restructured, so that smaller segments of sound such as syllables are represented, and ultimately, phonemes. The core idea is that, in the normal course of development, children’s phonological representations become increasingly segmental and distinctly specified in terms of phonetic features with age (see also Fowler, 1991).

According to Metsala and Walley (1998), lexical restructuring is relatively word-specific, depending on factors such as overall vocabulary size, rate of expansion, word frequency, familiarity, and the number of similar-sounding words in the lexicon (phonological neighborhood density). The traditional linguistic similarity metric for defining a phonological neighborhood considers neighbors to be words that differ by the addition, deletion, and substitution of a single phoneme. According to this metric, rime neighbors such as what, onset-vowel or lead neighbors such as cough, and consonant neighbors such as kit, are all considered to be equal phonological neighbors of a target word such as cot. Metsala and Walley propose that words with many similar-sounding neighbors (words in dense neighborhoods) should experience more pressure for phoneme-level restructuring than words with few similar-sounding neighbors (words in sparse neighborhoods). There is already evidence that neighborhood density affects the emergence of phonemic awareness (e.g., Metsala, 1999). However, as full segmental representation of phonemes is largely dependent on reading
tuition, full lexical restructuring at the phoneme level would not be an emergent property of vocabulary growth per se. Rather, prior to literacy, the development of segmental representation might depend critically on the nature of the words that constitute densely versus sparsely populated phonological neighborhoods.

It is clear from connectionism that brains learn the statistical structure of any input (e.g., Harm & Seidenberg, 1999). The argument here is that, for phonology, this statistical structure might emphasize the rime, at least in European languages. If phonological awareness emerges partly because of implicit processing of interitem phonological similarity relations as vocabulary grows, then the characteristics of the phonological lexicon might in themselves contribute to the psychological salience of onsets and rimes in prereaders. In other words, lots of phonological neighbors in the developing lexicon might be rhyming words.

Recently, my colleagues and I have analyzed all the monosyllabic words in English, French, and German in terms of phonological neighborhood similarity (see Goswami & De Cara, 2000; De Cara & Goswami, in press). The analyses for English were carried out by Bruno De Cara, using the Luce and Pisoni (1998) lexical database of 20,000 English spoken forms. The analyses in French were carried out by Ronald Peereman using BRULEX, a comprehensive lexical database for French spoken (and written) forms, and the analyses in German were carried out by Jo Ziegler using CELEX, which has a comprehensive lexical database for German spoken (and written) forms. The results are shown in Fig. 1.

As shown in the individual graphs, rime neighbors predominate in every language. Furthermore, rime neighbors are particularly prevalent in dense neighborhoods. In English, 58% of neighbors in dense phonological neighborhoods are rime neighbors if rime neighbors are defined in terms of onset substitution (e.g., cot: pot, shot, slot, spot . . .). In contrast, only 41% of neighbors in sparse phonological neighborhoods are rime neighbors (e.g., mud: blood, thud). If these statistical patterns actually affect the development of phonological awareness, then children should find it easier to decide that “cot” and “pot” rhyme than to decide that “thud” and “mud” rhyme.

![Fig. 1. Phonological neighborhood statistics for English, French and German.](image)

RN, rime neighbors; CN, consonant neighbors; OVN, onset-vowel neighbors. English: De Cara & Goswami, 3072 words. French: Peereman, 1766 words; German: Ziegler, 1422 words.
Given that these are all highly familiar and early acquired words, it may seem counterintuitive to propose that children will show better phonological awareness of one rime compared to another. However, if such an effect could be demonstrated, it would help us to understand the basis of phonological awareness. In essence, phonological awareness must be a consequence of how the brain processes language. If implicit comparisons between similar-sounding words are an important part of the emergence of phonological awareness, as suggested by Metsala and Walley’s (1998) lexical restructuring theory, then effects of neighborhood density should emerge in phonological awareness tasks, even when the child is recognizing a salient phonological unit in very familiar words.

In ongoing work, we are using two different phonological awareness tasks to test this hypothesis. One is the oddity task devised by Bradley and Bryant (1983), in which children must select the odd word out on the basis of rime (e.g., pit, hit, got). In our experiments, 5- and 6-year-old children are asked to make judgments about triples of words from dense neighborhoods, such as “hot, lot, wait,” and triples of words from sparse neighborhoods, such as “mud, thud, good.” The second is the same–different judgment task developed by Treiman and Zukowski (1996). Here children must decide whether two spoken words share a target sound or not. In our experiments, children are asked to make judgments about pairs of words from dense neighborhoods, such as “lick, sick” and pairs of words from sparse neighborhoods, such as “soot, foot.” Both tasks are intended to be measures of epilingual processing (see Gombert, 1992). By using epilingual tasks (in which children must recognize shared sounds), we hope to tap the level of phonological processing that might be expected to result primarily from spoken vocabulary growth and associated changes in the familiarity of individual lexical items and interitem phonological similarity relations.

In our current studies, we are finding significant effects of neighborhood density on rime processing (e.g., De Cara & Goswami, in press). Children are significantly more accurate at making judgments about rhyme for words from dense neighborhoods than for words from sparse neighborhoods. Overall, therefore, neighborhood density effects in rime processing do emerge in simple phonological awareness tasks in English. We are currently conducting similar studies in French and German via collaborations with Peereman, Leybaert, and Ziegler. If it is accepted that vocabulary development is a critical factor in the emergence of phonological awareness, then it is clear that the rime plays an organizing or

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2 Although Hulme et al. (2002) state that “the oddity task has undesirable psychometric properties” (p. 18), we have found the task to be a sensitive one in our own work. The oddity task is actually very similar to classic speech perception tasks based on oddity, such as those used to measure awareness of voicing and place. For example, the THRIFT battery uses 3-interval oddity tasks to measure whether children can identify the odd stimulus from a set of sounds such as “ata, ada, ata,” differing only in the voicing feature, or “meem, moom, meem,” differing only in vowel place (e.g., Hnath-Chisolm, Liapply, & Boothroyd, 1998). Similarly, investigations of prereaders have reported that the oddity task is one of the best measures to use in an early screen for later literacy difficulties (e.g., Majsterek & Ellenwood, 1995).
anchoring role for English phonology due to its dominant role in neighborhood similarity relations. If the rime turns out to have a similar role in other European phonologies, this could explain the apparently universal sequence of phonological development (from syllable to onset–rime to phoneme) that can be demonstrated in cross-linguistic studies of phonological development (e.g., Goswami, 1997, for a review). Note also that the onset–rime measures taken, but not the phoneme measures, were related to vocabulary development in the Hulme et al. (2002) dataset, as would be predicted from the foregoing version of the lexical restructuring hypothesis.

Rhyme and Theories of Reading Development

If the origins of phonological awareness lie in mounting neural pressure to reorganize the phonological lexicon as more and more similar-sounding words are acquired, then there is clearly an important role for rime awareness in phonological development. As we know that phonological awareness is important for reading, accordingly rime awareness should play a role in reading development, and indeed it does (e.g., Bradley & Bryant, 1983; see Goswami, 1999, for a recent survey). Hulme et al. (2002) demonstrate that, as soon as children start learning about letters, phoneme awareness (as measured by letter-based phonological awareness tasks) becomes the stronger predictor of reading. This is not a critical problem for what they term a large unit theory of reading development, as they seem to assume. In fact, I know of no exclusively large unit theory of reading development. Goswami and Bryant (1990) argued for at least three important causal connections in reading, an early connection from rhyme to reading, a parallel and early-operating connection from phonemes to reading, and a third later-operating connection from spelling to reading (see also Goswami, 1999). On the basis of their results, Hulme et al. appear to suggest that awareness of large units has no role to play in reading development in English: “It is clear that an alphabetic script operates by mapping letters onto phonemes” (p. 19). “The ability to learn to read effectively depends in turn upon creating mappings between graphemic orthographic representations and phonemically organized phonological representations” (p. 20). Connectionist models have demonstrated that “for learning to be efficient . . . the mappings need to operate at the level of graphemes and phonemes” (p. 19–20).

As demonstrated at the beginning of this reflection, none of these statements are accurate when considering the English orthography. Although English is indeed an alphabetic script, it does not operate solely by mapping letters onto phonemes (Berndt et al., 1994). In fact, it operates more consistently by mapping letter patterns for rimes onto body units. The ability to learn to read effectively does not depend only on creating mappings at the grapheme–phoneme level. In fact, to be a really effective reader of English, it is necessary to supplement such mappings with mappings for bigger spelling units such as orthographic rimes (termed “bodies” in the adult literature). Good empirical evidence that both English children (Goswami et al., 1997, 1998, Goswami, Ziegler, Dalton, &
Schneider, 2001) and English adults (Ziegler, Van Orden, & Jacobs, 1997) develop orthographic representations that code rimes is easy to find. Finally, there are rather few connectionist models of reading available at present, and only one of these has purposely built onset–rime coding into its architecture (Zorzi, Houghton, & Butterworth, 1998). Zorzi et al. showed that their model is actually more efficient at learning the spelling system of English than models that rely on grapheme–phoneme coding only. So rimes clearly play an important role in reading in English. The logical conclusion from Hulme et al.’s demonstration is surely that large units play a developmentally complementary role in reading acquisition to that played by small units.

A Developmental Resolution?

The key to resolving this confusion may lie in adopting a developmental view of the nature of the phonological representations that underlie the development of literacy. Prior to learning about letters, these phonological representations code relatively large units such as syllables, onsets, and rimes (although, of course, many onsets in English are single phonemes). As demonstrated above, if the representational system is coding the statistical structure of the input (i.e., the structural similarity relations in English phonology), then rime units will play a key role in phonological representation. Once orthographic learning commences, the system undergoes massive and usually rapid reorganization. Orthographic learning highlights single letters, and early systematic tuition typically focuses on letter–sound relations. Hence phonological representations are rapidly restructured to represent phoneme-level information. This arises because of mappings from spelling to sound, and not vice versa (as assumed by Hulme et al., p. 20).

However, the child soon discovers (or is taught) that the most consistent mappings from spelling to sound do not operate at the level of the single grapheme. Rather, they operate at the level of the rime. Therefore, the child learning to read English is forced to develop mappings at multiple levels, from graphemes to phonemes, from bodies to rimes, and also from whole word phonology to letter strings for words. Accordingly, children learning to read English develop grapheme–phoneme correspondences more slowly than children learning to read more transparent orthographies (see Goswami et al., 1998, 2001). The skilled reading system in English does not operate on graphemes and phonemes alone. Similarly, the developing reading system operates at multiple levels of psycholinguistic grain size (Goswami et al., 2001). This is why onset–rime awareness continues to predict reading development in English and why a model of reading acquisition based on small units only cannot adequately capture the processes involved in learning to read a nontransparent orthography.

REFERENCES


ROLE OF RHYME


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